



State of CERES



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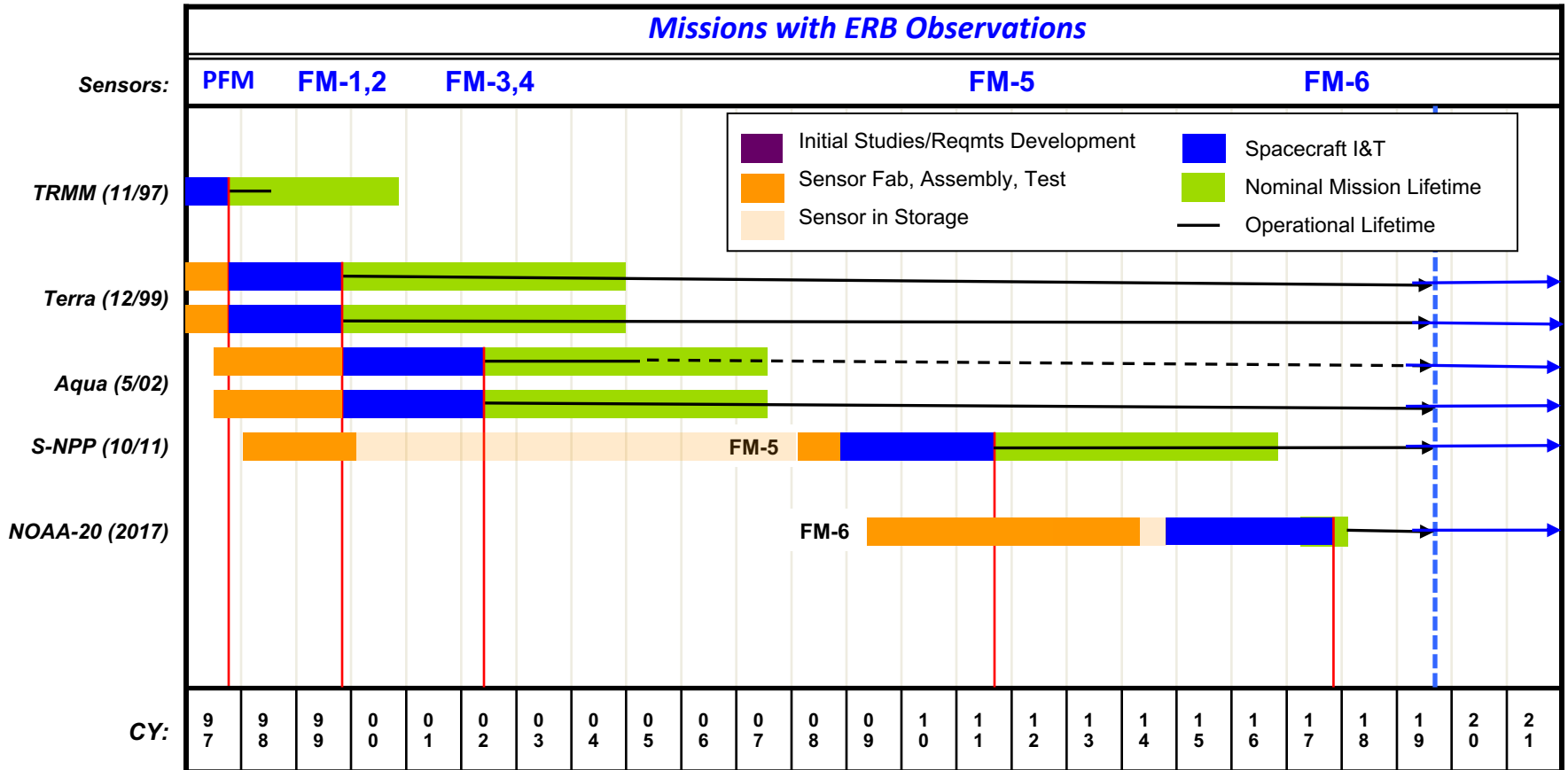
CERES Science Team Meeting, October 29-31, 2019
Lawrence Berkeley National Laboratory, Berkeley, CA

CERES Meeting (Tuesday)

Review Status of CERES Instruments and Data Products:

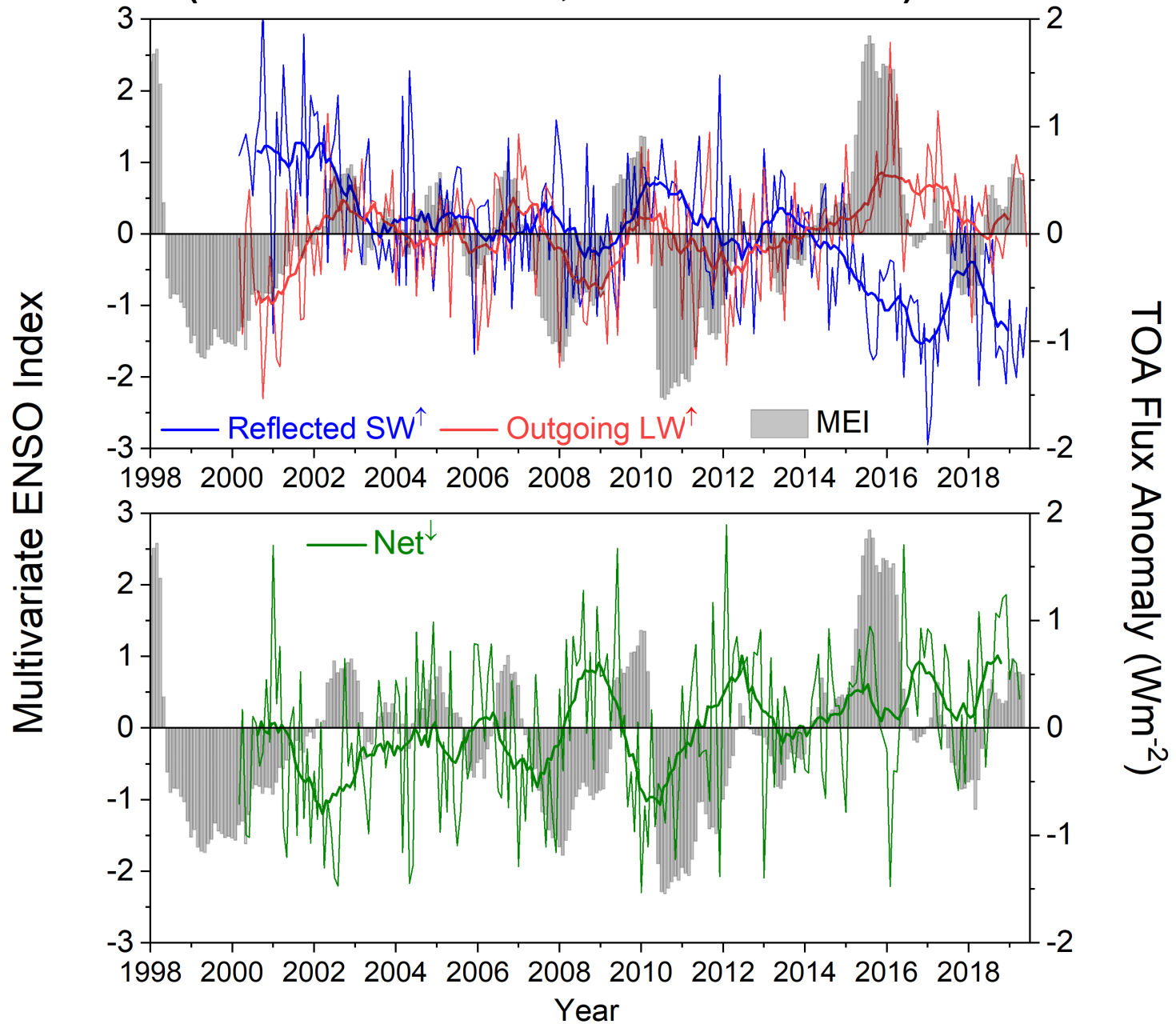
- Terra & Aqua Status & Plans for Edition 5
- SNPP Status and Plans for Edition 2
- Earth Venture Continuity-1 (EVC-1) Update
- CERES Terra, Aqua, S-NPP, NOAA-20 Instrument Calibration Update
- MODIS & VIIRS Cloud Algorithm & Validation Status
- ADM, SOFA, SARB and TISA Working Group Reports
- FLASHFLUX Update
- Data Management Team Update

CERES Flight Schedules



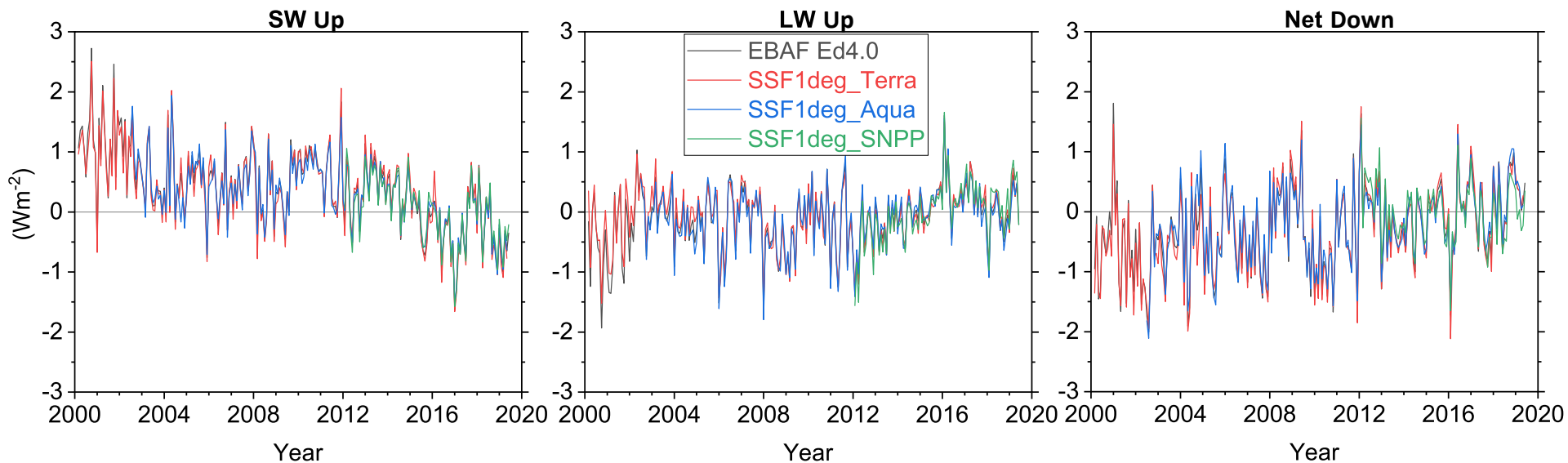
- Currently, 6 CERES instruments fly on 4 satellites: Terra (L1999), Aqua (L2002), SNPP(L2011), NOAA-20 (L2017)

Global Mean All-Sky TOA Flux Anomalies & Multivariate ENSO Index (CERES EBAF Ed4.1; 03/2000 – 06/2019)



Global Mean TOA Flux Anomalies

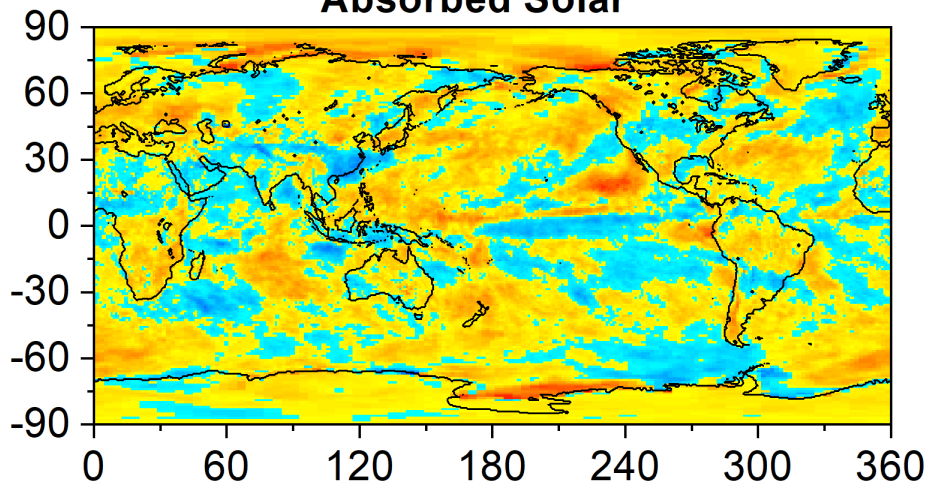
(Relative to Climatology for 02/2012-05/2019)



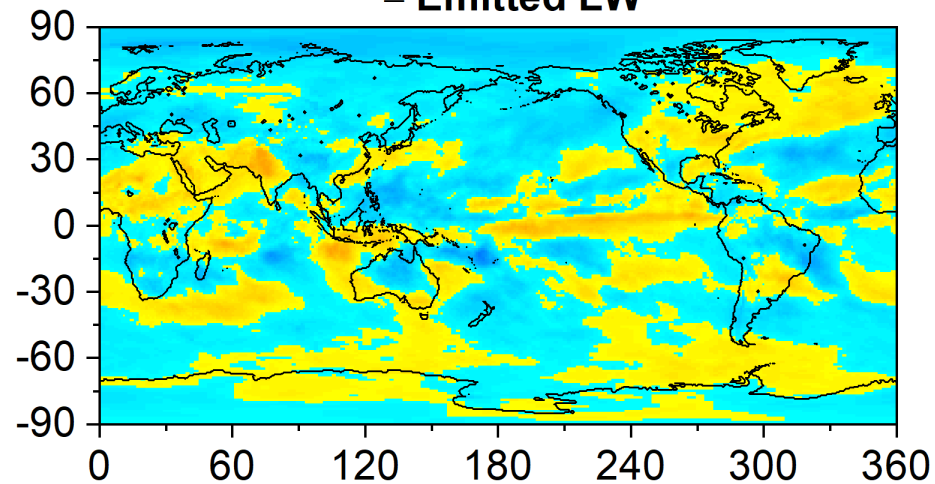
- RMS differences between Terra, Aqua and SNPP monthly anomalies for common period are: $< 0.2 \text{ Wm}^{-2}$ for SW and LW, and $< 0.25 \text{ Wm}^{-2}$ for net TOA flux.

TOA Radiation Changes (03/2000 – 06/2019)

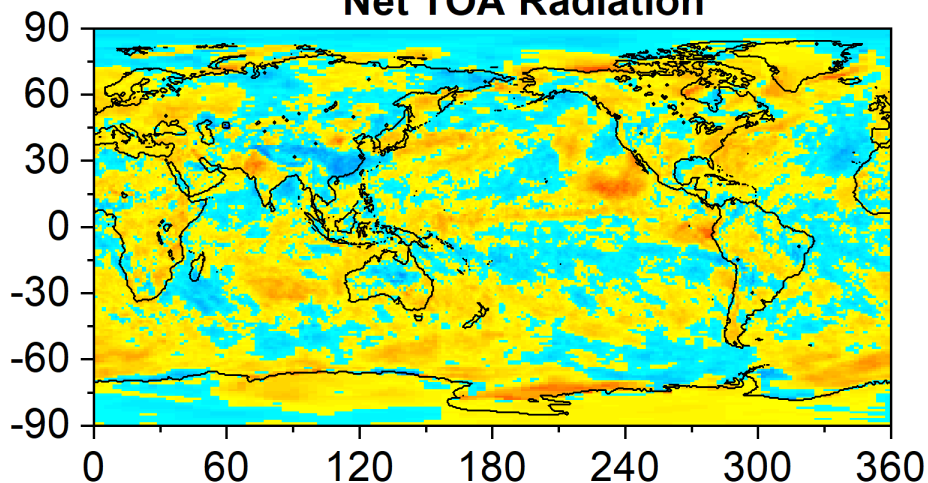
Absorbed Solar



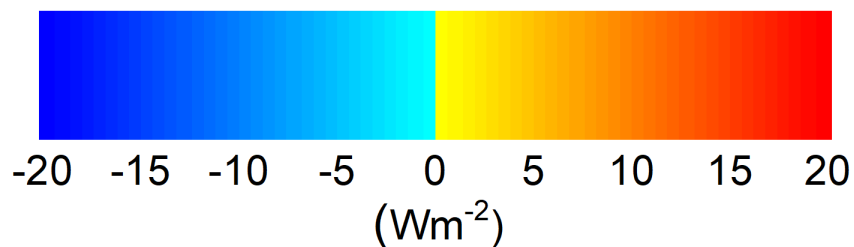
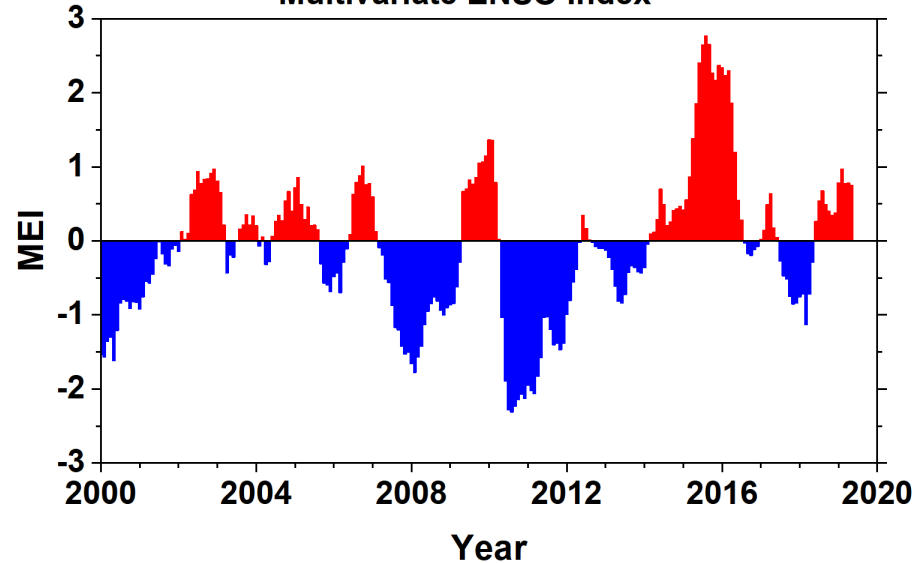
– Emitted LW



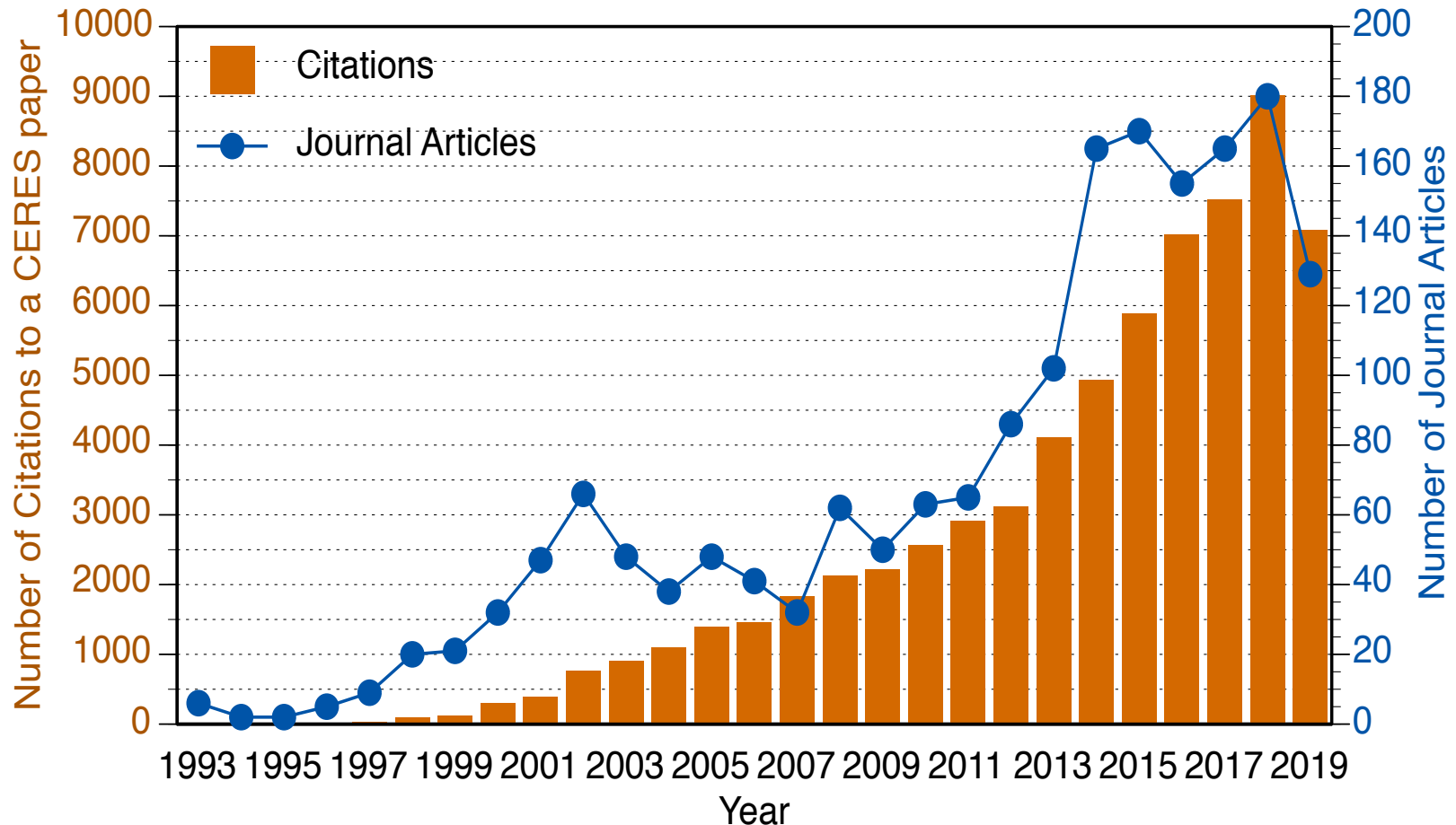
Net TOA Radiation



Multivariate ENSO Index



CERES Journal Publications and Citation Counts (For Papers Between 1993-2019; Updated October 14, 2019)



- Total number of peer-reviewed journal articles: 1,809
- Total number of citations to CERES papers: 66,991

(Compiled by Anne Wilber & Dave Kratz)

Number of Unique Users by CERES Data Product (through September 30, 2019)

Level	Product	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
1b	BDS	11	9	14	19	14	11	13	14	10	9
2	SSF	84	77	138	223	247	253	278	327	235	206
	FLASH_SSF	25	8	15	23	30	61	41	68	101	68
	C3M	31	32	33	37	28	55	54	49	49	29
	ES8	22	20	18	31	16	21	15	15	10	7
	SSF-MISR	9	4	2	5	4	2	1	3	1	1
3 & 3b	EBAF										155
	EBAF-TOA	72	160	346	484	579	580	540	646	668	513
	EBAF-Surface			147	289	375	424	464	510	484	353
	SYN1deg	70	168	199	353	382	438	494	607	639	564
	SSF1deg	77	126	107	157	166	160	194	190	159	168
	CldTypHist	17	12	37	57	41	40	47	86	87	61
	ES4	59	36	11	27	19	13	12	17	17	15
	ES9	21	12	5	13	9	5	5	8	6	4
	FLASH_TISA	17	18	20	17	15	15	36	52	65	58

• 67,410 unique Applied Science users ordered CERES data products via the POWER Web Portal

CERES Terra and Aqua Data Product Availability

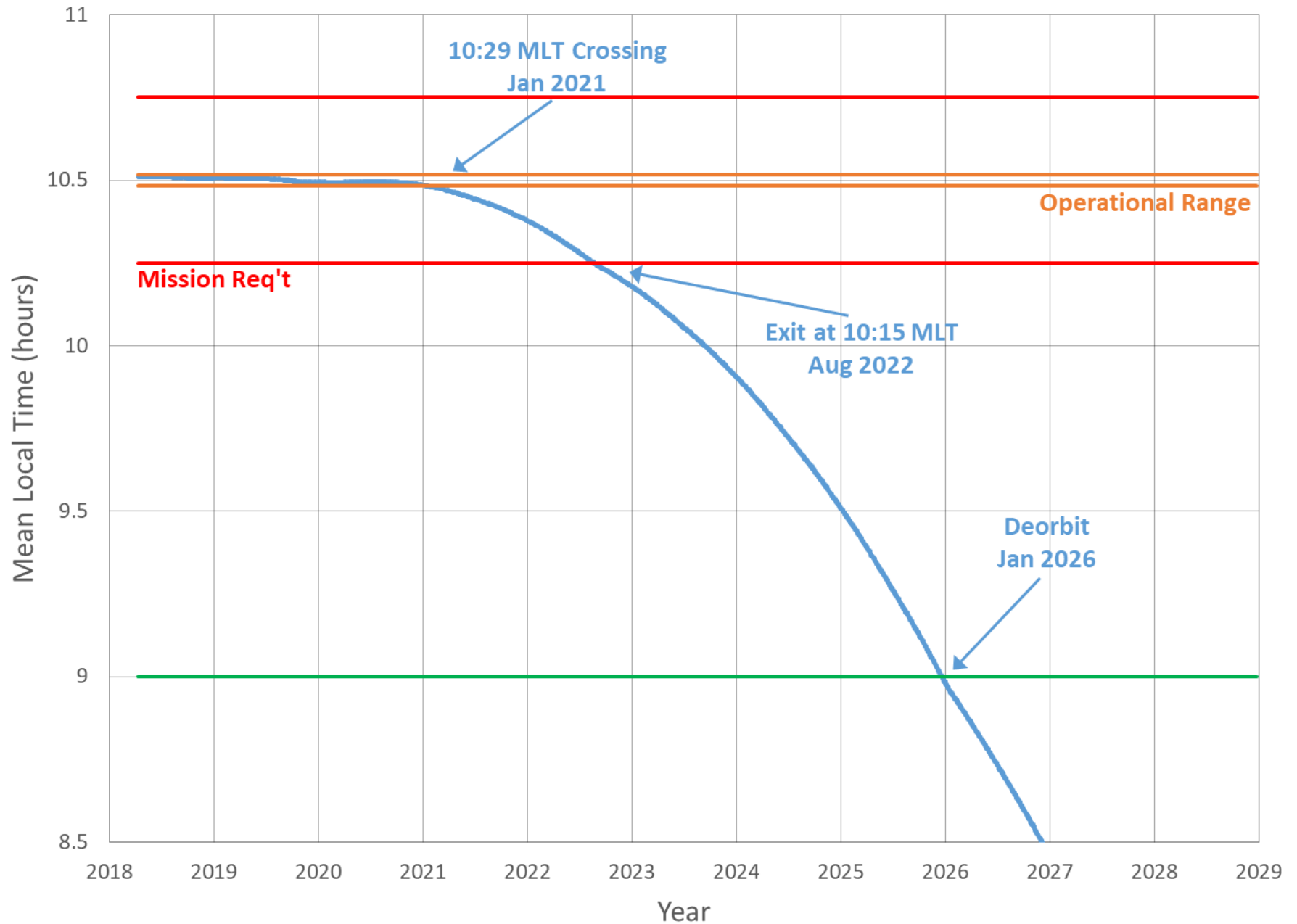
Data Product	Level	Ed4.0
BDS	1	05/2019
SSF	2	05/2019
SSF1deg	3	05/2019
SYN1deg	3	05/2019
CldTypHist	3	04/2019
EBAF-TOA	3b	06/2019
EBAF-SFC	3b	01/2019

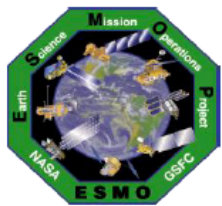
Planning for Terra & Aqua Edition 5

Main Considerations:

- 1) GMAO improvements to their atmospheric reanalysis system.
 - CERES and GMAO hold WebEx meetings every 3 weeks to gauge progress and provide ongoing validation results for the latest GEOS FP or FPIT version.
- 2) MODIS Collection 7 schedule.
- 3) Changes to Terra and Aqua MLT.
 - MLT starts to drift in 2021 (Terra) and 2022 (Aqua)
 - Ideally, this would be a good time to transition CDR from Aqua to NOAA-20 or S-NPP.
- 4) CERES production code improvements.
- 5) CERES algorithm improvements (particularly those enabling a seamless transition across satellite platforms).

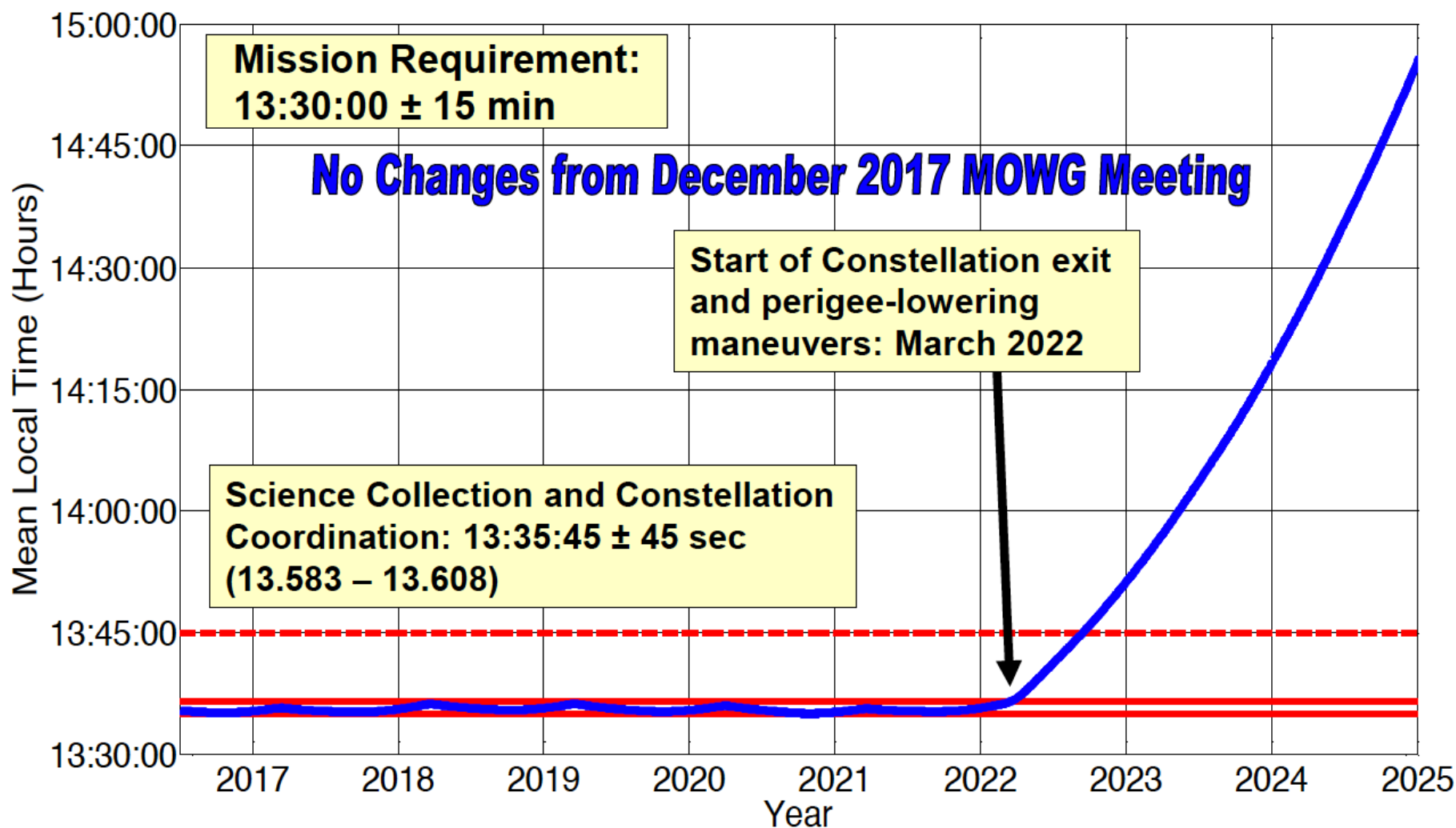
Terra Predicted Mean Local Time





Presented at ESC/A-Train MOWG Meeting on 12/6/2017

Aqua Predicted MLT with A-Train exit in March 2022



Terra and Aqua Mission Budgets

- The in-guide budgets for Terra, Aqua and Aura provided by NASA HQ this year are significantly lower in FY23 and beyond compared to last year's in-guide budget.
- The new in-guide budget ends data collection on Terra and Aqua 3-3.5 years sooner than what is achievable based upon available fuel and orbit drift considerations.
 - ⇒ Significantly increases risk of a data gap in ERB record.
- All three missions submitted over-guide requests at this year's annual budget review (PPBE) to restore the funding levels in last year's in-guide budget.
- Terra and Aqua will also make the case to restore the funding during the upcoming Senior Review in spring 2020.
- The in-guide budget for the Radiation Budget Science Project has not changed since last year.

S-NPP Edition1 Product Availability

Product	Platform	Processed through	Current	Publically Available
BDS	S-NPP	06/2019	Yes	Yes
SSF	S-NPP	06/2019	Yes	Yes
SSF1deg-Hour	S-NPP	06/2019	Yes	Yes
SSF1deg-Day/Month	S-NPP	06/2019	Yes	Yes
SYN1deg	Terra+S-NPP	10/2017	Yes	Yes

S-NPP Plans

Edition 1:

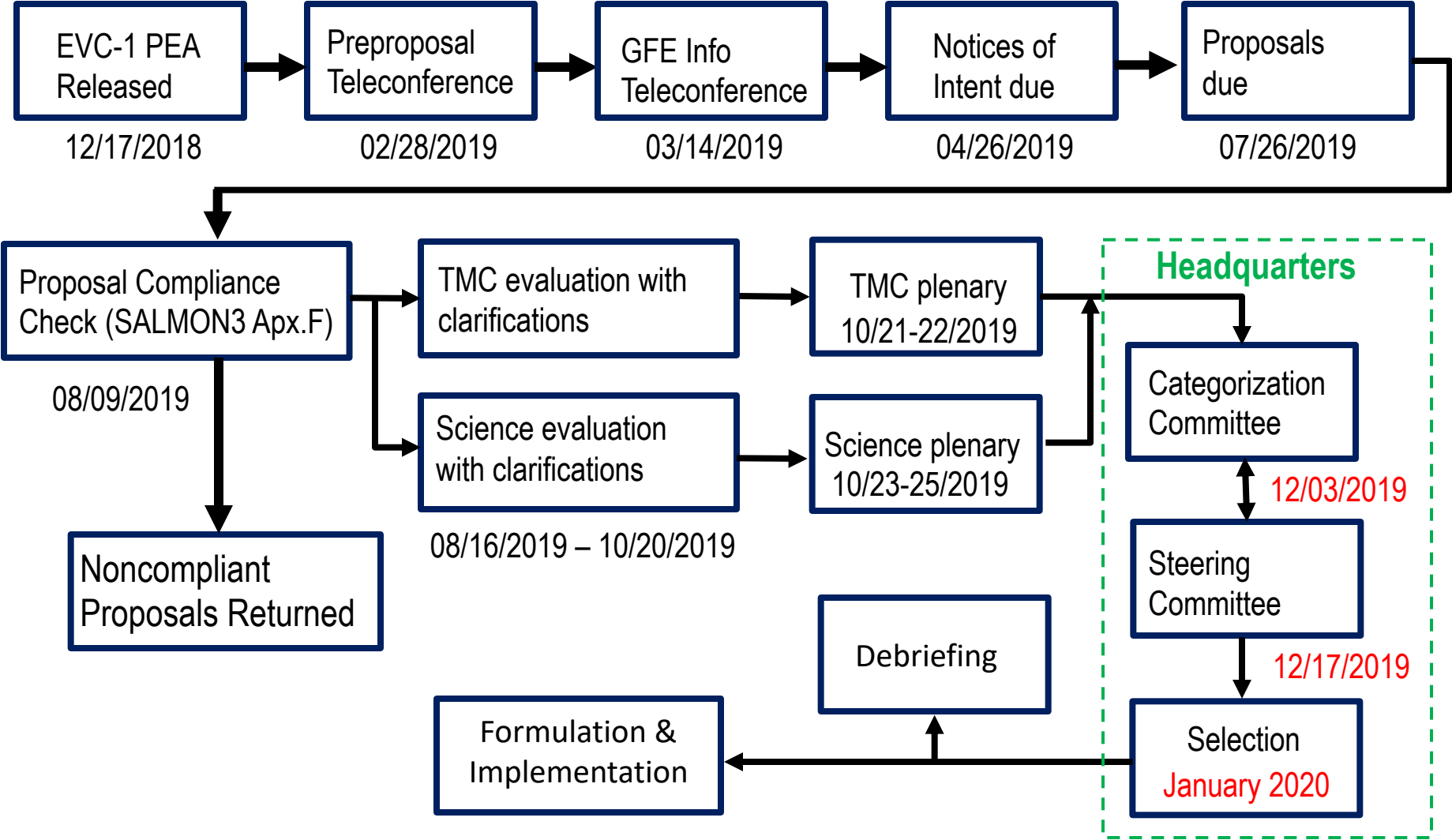
- Instrument gains (from onboard calibration) were taken into account. No attempt was made to place FM5 on same radiometric scale as FM3 or correct for spectral response function changes with time.
- ED1 cloud retrieval, ADMs, TISA & SARB algorithms were based upon those from Aqua.
 - Some changes to VIIRS cloud mask since water vapor and CO₂ bands are unavailable.
 - Cloud retrieval look-up tables were recomputed for VIIRS bands.

Edition 2:

- Will place FM5 on same radiometric scale as FM3.
- Will correct for FM5 spectral response function changes with time (LW daytime only).
- Will place VIIRS on same radiometric scale as MODIS Aqua, use the latest version of VIIRS level 1b, tune VIIRS cloud mask to be consistent with MODIS-Aqua.
- Will not ingest CrIS WV & CO₂ radiances to supplement VIIRS.
- FM5/S-NPP has been placed in restricted RAP mode to enable ADMs to be constructed. Will be used for FM5/S-NPP, FM6/NOAA-20 and beyond.



EVC-1 Selection Timeline





EVC-1 Selection Notes from Program Scientist

- **EVC-1 Selection Process is still on schedule.**
 - Selection meeting planned January 2020. Selection rollout expected several weeks later (maybe mid-February?)
- Technical, Management and Cost (TMC) Panel and Science Panel (SP) evaluations have been held.
- Remaining headquarters process includes:
 - Categorization committee meeting to categorize proposals on basis of TMC and SP results (from Category 1 – the best, to Category 4, the worst),
 - Steering Committee to check categorization committee work,
 - ESD decision process and development of ESD recommendation,
 - Presentation of recommendation to Selecting Official (Thomas Zurbuchen, head of the Science Mission Directorate),
 - Selection Decision,
 - Decision Rollout (9th floor concurrence, etc.)
- Government shutdowns could slow process but it looks like plans for November – February/March CR are not controversial, so hopefully will not be a problem.

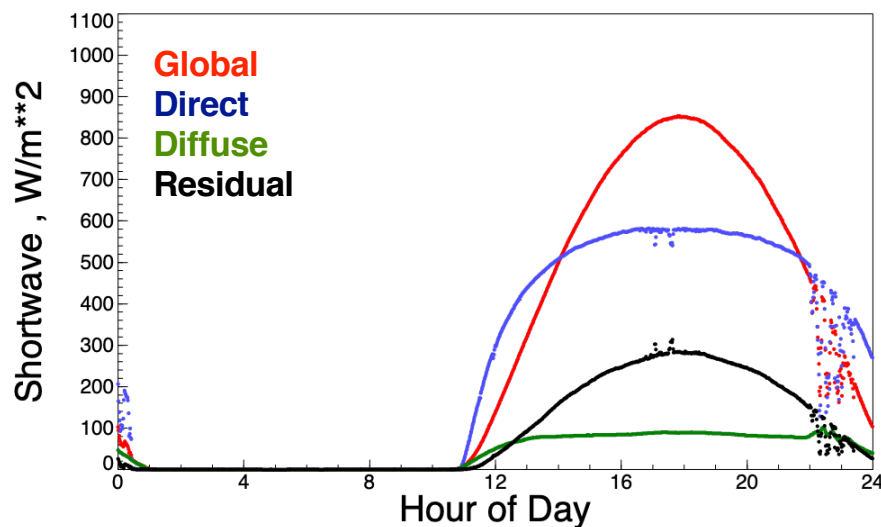
Granite Island



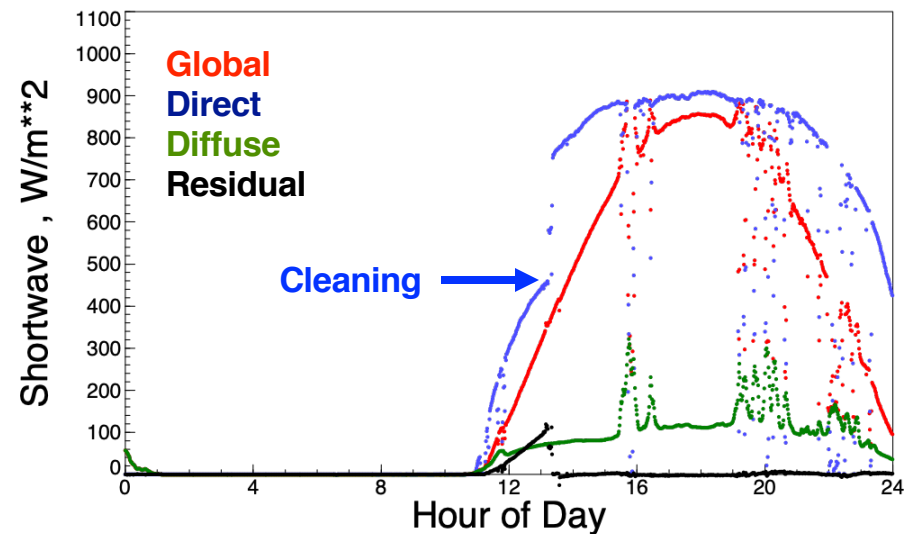
- 2.5 acre island located about 5 miles offshore in Lake Superior.
- Established shortwave, longwave, and AERONET in June, 2018.
- Site accepted by BSRN in July, 2018.
- Tracker broken for Winter 18/19; unsafe to repair until Spring 2019.
- Repaired tracker and data has been flowing since May 14, 2019.
- But a spider nested in pyrhelimeter ~June 29, as evidenced by residuals:

$$\text{residual} = \text{global} - (\text{direct} \times \cos(\text{SZA}) + \text{diffuse}) \gg 0$$
- Automated cleaning system was ineffective on spider.
- NMU student Elizabeth Hoffman cleaned all instruments on Aug 21.
- Working with SSAI to hire Ms. Hoffman on an "as needed" basis.
- Bryan Fabbri will present a talk at NMU during Fall trip to garner additional student interest.

Clear day, but residuals > 100 W/m²



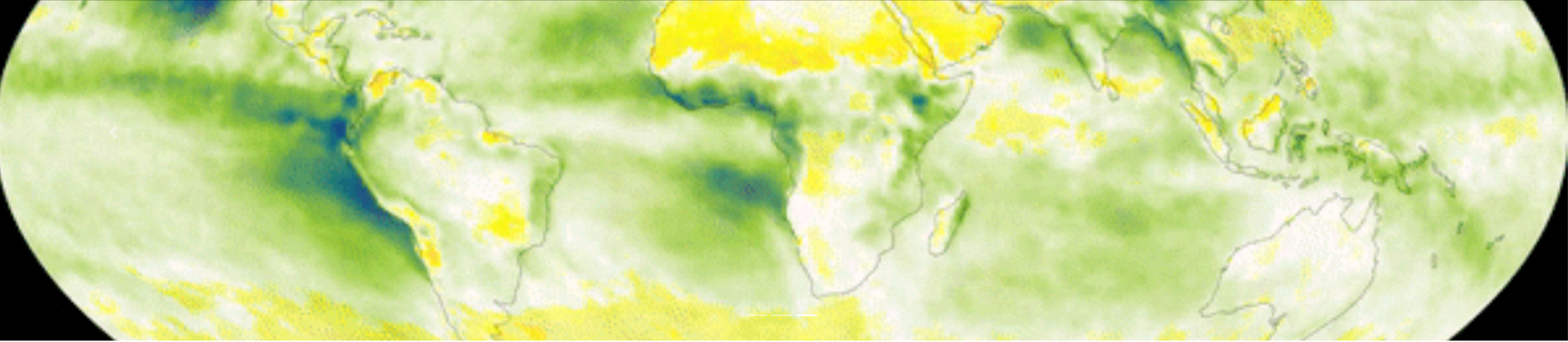
Cleaning immediately increases direct beam



Other Items

- 2020 Senior Review Proposals: Terra & Aqua.
- Terra@20 Celebrations at AGU
 - Dec. 8 from 6–8 pm at the Marriott Union Square Savoy. 480 Sutter St.)
- MDPI Special Issue (due April 30, 2020):
"Analysis of Decadal-Scale Continuous Data Products from Weather Satellite Platforms"
- CERES webpage redesign

CERES Webpage Redesign

[Home](#)[Science](#) ▾[Instruments](#) ▾[Data](#) ▾[Resources](#) ▾[News & Outreach](#) ▾[People](#)

What is CERES?

Climate is controlled by the amount of sunlight absorbed by Earth and the amount of infrared energy emitted to space. These quantities—together with their difference—define Earth's radiation budget (ERB). The Clouds and the Earth's Radiant Energy System (CERES) project provides satellite-based observations of ERB and clouds. It uses measurements from CERES instruments flying on several satellites along with data from many other instruments to produce a comprehensive set of ERB data products for climate, weather and applied science research.

The goals of the CERES project are to:

- Produce a long-term, integrated global climate data record for detecting decadal changes in the Earth's radiation budget from the surface to the top-of-atmosphere.
- Enable improved understanding of how Earth's radiation budget varies in time and space and the role that clouds and other atmospheric properties play.
- Support climate model evaluation and improvement through model-observation intercomparisons.

Upcoming Conferences & Meetings of Interest

Fall AGU

- December 9-13, 2019, San Francisco, CA.

AMS Annual Meeting

- January 12-16, 2020, Boston, MA.

European Geophysical Union

- May 3-8, 2020, Vienna, Austria.
- Session: The Earth's energy budget and the general circulation of atmosphere and ocean). Abstract deadline: 01/15/2020

Spring 2020 CERES Science Team Meeting

- April 28-30, 2020, NASA LaRC OR
- May 12-14, 2020, NASA LaRC
(Actual date depends upon 2020 Senior Review schedule)

International Radiation Symposium

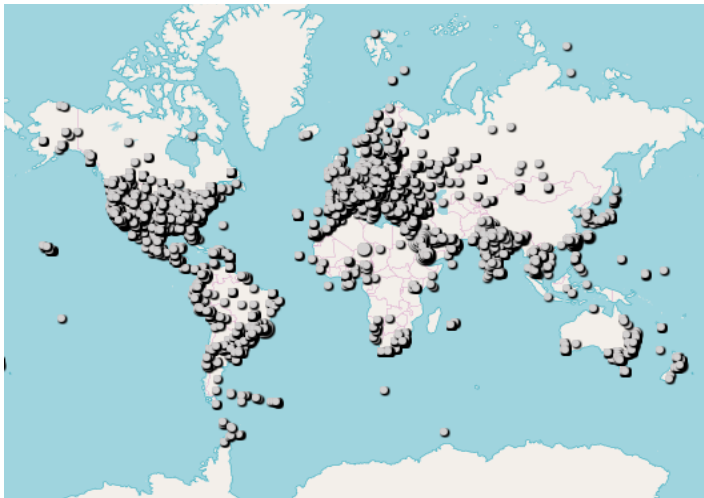
- July 6-10, 2020, Thessaloniki, Greece. Abstract deadline: 12/20/2019

IEEE International Geoscience and Remote Sensing Symposium (IGARSS)

- July 19-24, 2020, Waikoloa, Hawaii.
- Session: Remote sensing of Earth's energy budget

Let GLOBE Clouds be Your Outreach – Help us Spread the Word

Spring 2018 Data Challenge



The 2018 NASA GLOBE Clouds Spring Data Challenge received over **55,000 observations** from more than **15,000 locations** in **99 countries** in every continent!

Cloud Observations 2018-10-01 thru 2019-09-09 (no data challenge advertised)

GLOBE Observer App	68,327
GLOBE Program (mostly schools)	102,765
Total Observations	171,092
Aqua Matches	12,763
Terra Matches	12,352
GEO Matches	71,052
Total Match Emails Sent (data redistribution)	43,347

Access GLOBE Cloud Data coincident with satellite data: <https://observer.globe.gov/get-data/cloud-data>

NASA GLOBE Clouds Fall Data Challenge: What's Up in YOUR Sky?



Fall Cloud Challenge
Oct. 15 - Nov. 15

More information at <https://bit.ly/2lUmF5t>

Audience: Everyone! (formal/informal education and citizen scientists) *Help spread the word!*

Dates: October 15, 2019 - November 15, 2019

Observations: Clouds and aerosols (dust storms, haze, smoke)

Participants are invited to enter up to 10 observations per day of clouds and enter their data using any of GLOBE's data entry tools including the clouds tool on the **GLOBE Observer mobile app**.

As a reward, the GLOBE and GLOBE Observer participants with the most observations will be congratulated by NASA scientists with a video posted on the NASA GLOBE Clouds website.

Only those that enter their cloud observations using the GLOBE Online Data Entry website, GLOBE Data Entry app, or the GLOBE Observer app will be considered.

NASA ROSES Funding

Proposers to any ROSES program element are invited to incorporate citizen science and crowdsourcing methodologies into their submissions, where such methodologies *will advance the objectives of the proposed investigation*.

- Need handouts or resources on GLOBE Clouds for educators or general public?
- Curious about using GLOBE Clouds for research or learning more about ROSES Citizen Science funding?

Contact: Marilé Colón Robles, *GLOBE Clouds Project Scientist*
marile.colonrobles@nasa.gov

Science Mission Directorate Policy

Citizen Science

SMD Policy Document SPD-33

Recommended by SMD Science Management Council
Approved by SMD Associate Administrator

Responsible SMD Official: Director, Science Engagement and Partnerships (SE&P)

Original: SPD-33

I. BACKGROUND

Citizen Science is defined as a form of open collaboration in which individuals or organizations participate voluntarily in the scientific process in various ways (P.L. No. 114-329). This policy defines "Citizen Science Projects" as science projects that rely on volunteers.

The guidance in this SPD is in conjunction with other policies including Public Law Number 114-329 American Innovation and Competitiveness Act, 14 CFR 1221.110 Use of NASA Insignia, agency Open Data & Information policies (<https://open.nasa.gov/open-gov/>), and NASA Policy Directive 1382.17J NASA Privacy Policy.

II. POLICY

SMD Citizen Science Policy Document: <https://smd-prod.s3.amazonaws.com/science-red/s3fs-public/atoms/files/SPD%2033%20Citizen%20Science.pdf>

End